



Original Research Article

A Medico-legal Study Of Fatal Poisoning Cases Brought In A Tertiary Care Hospital

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Abstract

Introduction : Poisoning is said to have occurred if any substance interferes with the normal body functioning after being inhaled, swallowed, injected or absorbed on an acute or chronic basis.

Aim : To determine and analyse the various parameters of poisoning such as age groups, sex, manner of death and type of poisons in the state of Goa.

Methodology : This is a 4-yearretrospective study in a tertiary care hospital in the state of Goa brought for postmortem examination at the Department of Forensic Medicine, GMC, as a result of death due to poisoning. Suspected cases of poisoning with either a clinical diagnosis or positive chemical analysis reports were included in the study.

Results : Out of 6110 autopsies conducted during the study period, 307(5.02%) cases were confirmed cases of poisoning, out of which 63.52% were males, and 36.48% were females. The majority of deaths were suicidal, as per Police reports, and organophosphorus compounds were commonly used.

Conclusion : The data reflect the burden of poisoning deaths in the regions and calls for appropriate region-specific preventive measures to be adopted.

Keywords : Deaths; Poisoning; Organophosphate; Victims; Mortality

Introduction

The term *poison* first appeared in English literature around 1230 A.D. to describe a potion or draught prepared with deadly ingredients.[1] The word 'poison' is derived from the Latin word *POTUS* means to drink, to *poison* in old French, meaning a drink that could harm or kill.[2] Poison is a substance (solid, liquid, or gaseous) that causes harmful effects (i.e. disease, deformity, death)[2] to the body. It endangers an individual's life by its systemic or local effects or both. Poisoning is said to have occurred if any substance interferes with normal body functioning after being inhaled, swallowed, injected, or absorbed on an acute or chronic basis.[3]

According to World Health Organization, about 3 million acute poisoning cases occur worldwide, with about 22000 deaths every year. 90% of these fatal poisonings occur in developing countries.[4] According to the annual Accidental Deaths and Suicides in India 2018, National Crime Records Bureau, Ministry of Home Affairs report, out of 4,11,824 accidental deaths in India in 2018, 5.3% were attributed to poisoning; and out of 1,34,516 suicidal deaths in India in 2018, 26.7% were attributed to poisoning.[5]

The mortality resulting from poisoning varies from country to country, depending on the types of poisons encountered, the extent of awareness about poisoning, availability of timely treatment, and qualified medical personnel. A pattern of poisoning in a particular region depends on various factors such as access to poisons, household issues, socio-economic conditions, work-related issues, cultural and religious influences etc. Knowledge of the pattern of

poisoning in a particular area will help early diagnosis and better treatment, thus reducing morbidity and mortality. The exact incidence of poisoning in India is uncertain due to the lack of data at the central level, due to the under-reporting of cases, and mortality data is a poor indicator of the incidence of poisoning. It is believed that 5-6 persons per lakh of a population die due to poisoning each year. It is estimated that over 50,000 people die in India from toxic exposure.[3,4,6]

Identifying and managing poisoning cases is a practical challenge for treating doctors and investigating agencies. Some poisons can cause death, injury or permanent harm to organs by chemical reactions or other activity on the molecular scales when exposed to a sufficient quantity, making the prognosis difficult and raising morbidity and mortality rate.

The current study's objective was to identify the range of substances used for poisoning in the study area, identify the vulnerable age groups, identify the most affected sex, and determine the most common manner of death in case of poisoning in the study area. The study aims to analyse the instances of various poisoning encountered in the Department of Forensic Medicine and Toxicology in a tertiary care facility in Goa. The study ultimately aims to stress the importance of setting up regional Poison Information Centers, which can guide the treating doctors, and the general public, and significantly reduce the mortality and morbidity of poisoning cases by generating public awareness on poisoning, ensuring proper first aid, and imparting much needed toxicological diagnostic and therapeutic assistance to treating doctors.[4]

Methodology

The present study was a retrospective, cross-sectional, a record-based study by accessing autopsy reports, chemical analysis reports, police inquest papers, and hospital records in cases brought to the Department of Forensic Medicine and Toxicology at Goa Medical College as a result of death due to poisoning.

Cases brought for autopsy from 1st January

2015 to 31st December 2018 for four years were considered for the study. Analysis of autopsy reports, patient case records, history by patient or relatives, police report, chemical analysis reports were done, and the data was collected. Data collected included date, age of deceased, sex of deceased, manner of death, and poison involved and was entered in tabular form. Finally, the details were analysed, and conclusions were drawn after comparing and discussing similar studies. All confirmed cases of poisoning, including chemical, organic, pharmaceuticals, drugs, and envenomation, were included in the study. At the same time, bodies in the advanced stage of decomposition and cases with ambiguity regarding the diagnosis of poisoning were excluded from the study.

Results

There were 6110 autopsies conducted in the Department of Forensic Medicine and Toxicology, Goa Medical College, during the study period. Only 307 (5.02%) were confirmed cases of poisoning as per the study criteria. There were 195 (63.52%) males and 112 (36.48%) females affected, with a male to female ratio of 1.741:1. Organophosphorus compounds were the most commonly used poison, causing death in 81 cases (26.38%), followed by Zinc Phosphide being the cause of 63 deaths (20.52%). Suicides were the major manner of death, seen in 79.15% of the poisoning deaths, while accidental poisoning cases were noted only in 20.85% cases. No case of homicidal poisoning was observed during the current study. Maximum mortality was observed in the age group of 21-30 years (85 cases, 27.69%, 54 males and 31 females), followed by 31-40 years age group (73 cases, 23.78%, 50 males and 23 females); with male preponderance.

Discussion

In the present study, we tried to find the association of cases of fatal poisoning with various factors such as age, gender, type of poison and manner of death. Other researchers have dealt with these factors in multiple permutations and combinations.

The incidence of fatal poisoning cases (307)

in the present study with respect to the number of autopsies (6110) is 5.02%. The incidence of poisoning cases shown in a study by Sanjeev Kumar et al. is 10.02%.[7] The study by Gupta et al. showed an incidence of 15.98%.[8] Out of the 307 cases, a more significant percentage of poisoning was observed in males than females. There were 195 (63.52%) males and 112 (36.48%) females affected, with a male to female ratio of 1.741:1. Males being affected more were noticed in other similar studies. In his study, K Srinivasulu et al. showed a male to female ratio of 1.63:1;[6] P Ravikumar showed a male to female ratio of 2.59:1;[9] Kailas N. Chintale et al. study showed the male to female ratio of 2.9:1.[10] However, other studies such as Dipayan Deb Barman et al. showed male to female ratio of 0.745:1; (11) study by Shagun Thakur et al. showed male to female ratio of 1:1.2;[12] study by T Karikalan et al. showed a male to female ratio of 0.429:1, showing female preponderance.[13]

Maximum mortality was observed in the age group of 21-30 years (85 cases, 27.69%, 54 males and 31 females), followed by 31-40 years age group (73 cases, 23.78%, 50 males and 23 females); with male preponderance. According to age and sex (Fig 3), the incidence of poisoning reveals an increasing trend up to 30 years and then declines with a peak incidence of the age group 21-30 years. Academic failure, family disharmony, unemployment, and emotional instability are common causes for committing suicide in this age group. Similar results were observed in other studies. In K Srinivasulu et al., the age group of 21-40 years had the most number of poisoning cases.[6] In the study by Bhagora et al., in a study comprising 165 poisoning cases, 47 cases (28.49%) were from the age group of 21-30 years, which was the maximum occurring age group in that study.[14] However, studies such as Tandle et al. have found the age group of 31 – 40 years to be the most affected, which is explained that in this age group, individuals were more active, bread earners, and hence facing more stressful activities.[15]

In the present study, suicides constituted 243 cases (79.15%), 146 were males, and 97 were

females. The remaining 64 cases (20.85%) were accidental, of which 49 were males and 15 were females. No cases of homicidal poisoning were encountered during the study period. Most of the studies showed the highest number of suicidal poisonings, followed by accidental poisoning.[6–16] Homicidal poisoning incidences were minimally observed (4%, 5%, 1.57%, and 0.6%) in a few studies.[11,12,15,16]

Organophosphorus compounds were the most commonly used poison in the present study, resulting in 81 deaths (26.38%), followed by Zinc Phosphide being the cause of 63 deaths (20.52%). Organophosphorus compounds were the most commonly used suicidal agent in several studies.[6,8–12,14–16] In the study conducted in Tamilnadu (South India) by T Karikalan and M Murugan, it was found that Cow Dung Powder (commercially available synthetic type, available in two different colours- yellow powder 'Auramine O' and green powder 'Malachite Green'), though its sale is legally banned since 2007, was widely used in rural regions as a poison. Various researchers have aptly said that the pattern of poisoning in a region depends on availability, cost, access to a toxic agent, socio-economic status, and cultural and religious characteristics. Following Cow Dung Powder, therapeutic drugs, household products such as phenol, hair dye, bleaching powder, etc. Lastly, organophosphates were used. Despite being the most common poison consumed in our country, only 9.4% of cases had organophosphate compounds in the study.[13] Sanjeev Kumar et al. from the Southern Rajasthan study showed Aluminium Phosphide as the most common agent for poisoning, followed by Organophosphorus compounds.[17] The study by Indrani Banerjee from West Bengal revealed the most common agent of poisoning in her study as snake bites, followed by Organophosphorus compounds.[18] Therapeutic drugs were the commonest poisoning agent in a few studies.[19–21]

The incidence, morbidity and mortality can be reduced by implementing preventive strategies and solutions. Suggestions from various authors in similar studies have also been included below :

- i. Health programs should be designed and implemented to prevent suicidal and accidental poisoning. As the affected age groups involve young adults, a multidisciplinary approach might be needed to address the issue of self-poisoning. Proper psychiatric guidance, affection, and consultation to be provided to a vulnerable group of people such as people with psychosocial, financial, and social problems.
- ii. The incidence of suicide in married couples can be reduced by developing good interpersonal relationships.
- iii. Poisoning awareness and basic first aid knowledge to be taught to the community. Students from the high school level to be compulsorily taught to administer first aid in case of emergencies such as animal bites, stings etc.
- iv. Harmful household substances to be kept at places not accessible to children and psychiatrically ill people. Administer drugs to the elderly to prevent accidental overdosing by them.
- v. Proper precaution in the form of headgear, suitable protective clothing etc., while going to fields to prevent envenomation.
- vi. There should be strict implementation of the Pesticides act. Strengthen legislative measures regarding the sale of drugs and chemicals (pesticides) and implement those measures. Strict restriction regarding dispensing over-the-counter medicines/pesticides without physician / agricultural scientist proper prescription.
- vii. Governments provide the farmer's financial support, insurance, and subsidies in crop failures and other natural calamities.
- viii. Identify poisoning cases and provide the quickest access for prompt treatment. Reduction in the delay of treatment can significantly reduce the number of fatalities related to poisoning.
- ix. To have a Toxicologist available 24x7 in every casualty to guide the physicians in treating poisoning cases.
- x. Establish Poison Information Centres with access throughout the day to benefit health care workers and the general public. They can provide toxicity assessment and treatment recommendations over the phone and effectively guide the treatment of newer poisons.
- xi. Well-equipped Clinical Toxicology Units and associated clinical toxicological laboratories at tertiary level hospitals can help in early detection, accurate diagnosis, better management, and reduce morbidity and mortality in poisoning patients.
- xii. Highly equipped health care centres to have adequate antidotes of common poisons encountered locally. A small percentage of ward and ICU beds should be reserved to treat poisoning cases.
- xiii. CME programs should be regularly conducted to bring the treating fraternity up to date with current trends in poison management.
- xiv. Provide psychiatric evaluation and rehabilitation to prevent future attempts of suicide attempt survivors.

Conclusion

Our study was conducted in a tertiary care hospital to find the incidence, age, gender relationship, manner of death, and the most common type of poison used pertaining to fatal poisoning cases in the state of Goa. In our study, most of the poisoning was due to the consumption of insecticides, followed by rodenticides, which are readily available over the counter and account for a significant amount of morbidity and mortality in developing countries like India. Suicide was the commonest manner of death. The occurrence was high in males, especially in the age group of 21-30 years. The pattern of fatal poisoning in the present study was more or less similar to the pattern observed by various authors. This study was done in a single tertiary care hospital. A multicentric, nationwide study could address the study objective even better. Further research considering the marital status, socio-economic status, educational status of the poison victim, month based and season-based variations in incidence, time of consumption of poison, time

from administration to initiation of treatment, the outcome of poisoning episodes can throw a better light on to the profile of poisoning. National Crime Records Bureau's Accidental Deaths & Suicides in India 2018 report claims that poisoning (26.7%) is the second prominent means of suicide in India, second to hanging (51.5%). As no reliable data regarding poisoning is present, a National Poison Registry, similar to those followed in USA or U.K., can be beneficial.

Conflicts of interest/Competing interests:
None

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Table 1. Incidence of Poisoning related autopsies in GMC

Year	Number of autopsies	Poisoning Cases	Males	Females
2015	1333	62	40	22
2016	1500	79	52	27
2017	1689	85	53	32
2018	1588	81	50	31
Total	6110	307	195	112
Percentages		5.02	63.52	36.48

Table 2. Year-wise analysis based on age groups

Age Group	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	Total
2015	0	8	17	17	5	2	8	5	0	0	62
2016	0	10	25	10	10	7	13	4	0	0	79
2017	1	9	22	25	5	5	10	6	1	1	85
2018	1	4	21	21	12	9	5	5	0	3	81
Total	2	31	85	73	32	23	36	20	1	4	307
Percent	0.65	10.1	27.6	23.7	10.4	7.4	11.7	6.5	0.3	1.3	100

Table 3. Age-wise analysis based on sex

Age Group	Males	Females	Total	Percentage
0-10	1	1	2	0.6
11-20	13	18	31	10.1
21-30	54	31	85	27.6
31-40	50	23	73	23.7
41-50	24	8	32	10.4
51-60	15	8	23	7.4
61-70	20	16	36	11.7
71-80	16	4	20	6.5
81-90	1	0	1	0.3
91-100	1	3	4	1.3
Total			307	100

Table 4 Manner of death

Year	Suicidal			Accidental			Homicidal			Total
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
2015	30	21	51	10	1	11	0	0	0	62
2016	40	22	62	12	5	17	0	0	0	79
2017	40	29	69	13	3	16	0	0	0	85
2018	36	25	61	14	6	20	0	0	0	81
Total	146	97	243	49	15	64			0	
Percentages		79.1			20.8			0.0		

Table 5. Yearly distribution of poison cases

Year	Corrosive acid	Ethyl Alcohol	Herbicide	Kerosene	MDMA\	Oil of Winter green	Organo Chlorine	Organo Phosphates	Pyrethroid	Snake Bite	Strychnine	Therapeutic drugs	Yellow Phosphorous	Zinc Phosphide	Total
2015	1	9	8	1	1	0	2	16	1	1	0	4	7	11	62
2016	2	9	7	2	2	1	2	22	0	3	0	9	1	19	79
2017	2	10	11	1	2	0	2	23	1	2	1	6	7	17	85
2018	3	10	9	1	6	1	2	20	0	3	0	10	0	16	81
Total	8	38	35	5	11	2	8	81	2	9	1	29	15	63	307
Percent	2.6	12.3	11.4	1.6	3.5	0.6	2.6	26.3	0.6	2.9	0.3	9.4	4.8	20.5	100

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